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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/620,453	GAZOR ET AL.
	Examiner	Art Unit
	Qi Han	2626

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 May 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13,16-18,22 and 24-26* is/are rejected.

7)☒ Claim(s) *14-15, 19-21, 23* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Response to Amendment

2. This communication is responsive to the applicant's amendment dated 05/29/2007. The applicant(s) amended claims 1, 10-11, 14, 22-24 (see the amendment: pages 2-7).

The examiner withdraws the disclosure objection, because the applicant amended the corresponding content of the specification.

The examiner withdraws the claim rejection under 35 USC 101, because the applicant amended the corresponding claim(s) and the applicant's arguments (see RAMARKS in the amendment: page 9) are persuasive.

The examiner withdraws the claim rejection under 35 USC 112 2nd, because the applicant amended the corresponding claim(s).

Response to Arguments

3. Applicant's arguments filed on 05/29/2007 with respect to the claim rejection under 35 USC 102/103, have been fully considered but are moot in view of the new ground(s) of rejection, since the amended claims introduce new issue and/or change the scope of the claims. It is also noted that, the previous cited references are still applicable to the newly amended claims for the prior art rejection (see below).

In response to applicant's arguments (REMARKS in the amendment: page 10) regarding rejection under 35 USC 103 that "Erten does not teach or fairly suggest that respective parameters (e.g. the variance) of the Lapacian or Gausian distributions are recursively updated, based on the results of processing each successive frame, as is required by the present invention" (page 10, paragraph 3), the examiner respectfully disagrees with applicant and has a different view of prior art teachings and the claim interpretation. It is noted that Erten discloses the voice extractor 26 implementing mathematical model with parameter matrices (p42-p43) which are updated with time index (k or t) (p73, p86), which is reasonably read on the claimed "recursively updated". Erten also discloses that voice detector using windowed signals (successive frames) and properties (parameters) including power, magnitudes, phase and statistical properties (p107-p108), and teaches that 'voice signals tend to have Laplacian probability distribution', 'noise signals...tend to have a Gaussian or Super-Gaussian probability distribution', and 'the variance of extracted speech signal 28 or speech frequency bands 160' and 'various other statistical measures... may be extracted as properties of speech and noise signals or frequency bands' (p110), which means these properties (parameters) are updated in each windowed signal (frame) basis (reads on recursively updated). Therefore, Erten discloses the argued limitation, based on the broadest reasonable interpretation of the claim (such as claim 1).

For above reason, the applicant's argument is not persuasive.

Claim Rejections - 35 USC § 103

4. Claims 1-4, 6, 10-11, 16-18, 22, and 24-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over ERTEN (US 2002/0116187 A1).

As per **claim 1**, as best understood in view of the rejection under 35 USC 101 (see above), ERTEN discloses 'speech detection' (title), comprising:

"decomposing a frame of the noise-contaminated signal received in a predefined time period into decorrelated signal components" (Fig.8, and paragraph (hereinafter referenced as p)106, 'time window (predefined time period)'; p107, 'frequency converter 158 generates (decomposes) speech frequency bands ...from windowed speech signal (frame)152', 'implement a fast Fourier transform (FFT) algorithm', wherein Fourier transform inherently decomposes the windowed signal (frame) into uncorrelated signal components; Fig. 5, shows separation of speech 60 and noise 30, which can also be read on the claim); and for each component:

> "recursively updating respective parameters characterizing a Gaussian noise distribution and a signal distribution of each of the respective components as a function of time", (p42, 'parameter matrices' and 'continuous-time dynamics or discrete-time state' (function of time); p49, 'mixing environment can be modeled as the following nonlinear discrete-time dynamic processing model (function of time)'; p53, 'the update law for dynamic environments (corresponding to recursively updating) is used to recover the original signals' and 'environment 42 is modeled as linear dynamical system'; p110, 'voice signals tend to have Laplacian probability distribution' and 'noise signals...tend to have a Gaussian or Super-Gaussian probability distribution'; p103, 'properties (also corresponding to parameters) can convey any information' including 'power, statistical properties, spectral properties, envelop properties, proximity...'; also see p43, p73, p86, p107-p108);

"using the respective parameters to evaluate a [composite Gaussian and signal] distribution function to provide estimate of noise and signal contributions to the component" (p110, 'the variance (estimate)...may be used to determine (evaluate) the presence of voice (corresponding to signal contributions)' and 'various other statistical measures, such as kurtosis, standard deviation ...may be extracted as properties (estimates) of speech and noise signals or frequency bands (components)'; Figs. 2-5, 'mixed environment' (corresponding to a distribution function)); and

"attenuating the component in proportion to the estimated noise contribution to the component" (p105, 'attenuator 142 attenuates extracted speech signals 28 based on detection parameter 140; p113, 'speech detected signal 212 has such noisy periods attenuated' and Figs. 14-15 also shows signal 212 is attenuated in proportion; p108, 'frequency band output 168 may include speech frequency band 160 scaled by the ratio of speech in-band power to noise in-band power (implying the claimed limitation)').

But, ERTEN does not expressly disclose the distribution function being "**composite Gaussian and signal** distribution function". However, as stated above, ERTEN teaches that 'voice signals tend to have Laplacian probability distribution' and 'noise signals...tend to have a Gaussian or Super-Gaussian probability distribution' (p110), and processing the mixed signal in 'mixed environment' (Figs. 2-5). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to recognize that the mixed signal would have a mixed (joint or composite) distribution that corresponds to the mixed environment, and to combine the teachings of ERTEN by providing a mixed (joint or composite) distribution that reflects the mixed signals with properties of Laplacian probability distribution (for speech) and

Gaussian probability distribution (for noise) in the mixed environment, because either of speech and noise has its own probability distribution as suggested by ERTEN and the mixed signal is necessarily associated with a mixed (joint or composite) distribution to reflect properties of the mixed signal and noise distribution in the mixed environment.

As per **claim 2** (depending on claim 1), the rejection is based on the same reason described for claim 1, because the rejection for claim 1 covers the same or similar limitation(s) as claim 2.

As per **claim 3** (depending on claim 1), the rejection is based on the same reason described for claim 1, because the rejection for claim 1 covers the same or similar limitation(s) as claim 3, wherein 'time window' and 'windowed speech signals' inherently include the claimed "a predefined number of samples" and FFT also inherently includes the claimed "applying a matrix transform".

As per **claim 4** (depending on claim 1), the rejection is based on the same reason described for claim 1, because the rejection for claim 1 covers the same or similar limitation(s) as claim 4, wherein 'FFT' inherently includes the claimed "mapping…from a time domain to a frequency domain".

As per **claim 6** (depending on claim 1), the rejection is based on the same reason described for claim 1, because the rejection for claim 1 covers the same or similar limitation(s) as claim 3, wherein 'Fourier transform' inherently includes the sinusoidal functions as basis functions as claimed.

As per **claim 10** (depending on claim 2), ERTEN discloses "using a value computed during processing of a previous frame were processed to determine which of the parameters

characterizing the respective distribution to update" (Fig. 7 and p104-105, 'detection parameter ...may be scaled...or ...a binary value', which is used to 'attenuates (update) extracted speech signal'; also see Fig. 8 and p108).

As per **claim 11** (depending on claim 10), ERTEN does not expressly disclose "wherein the value computed during processing of a previous frame is an a priori probability that the frame constitutes noise, and using the a priori probability to select which of the parameters to update comprises: selecting a measure of variance that characterizes the Gaussian noise distribution if the a priori probability is below a predetermined threshold; and otherwise selecting a measure of variance factor that characterizes the Laplacian distribution." However, ERTEN teaches that using 'probability density of the Jth component (interpreted as a priori probability of components, including noise)' (p47); 'speech likelihood signal may be a binary signal or may expressed some probability that speech has been detected' (p114); 'a binary value resulting from comparing the operation results to one or more threshold values' (p104); 'voice signals tend to have Laplacian probability distribution...noise signals...tend to have a Gaussian or Super-Gaussian probability distribution...thus voice signals can be said to be of low variance', 'the variance of extracted speech signal or speech frequency bands may be used to determine the presence of voice' and 'various other statistical measures...my be extracted as properties of speech and noise signal or frequency bands' (p110). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to recognize that the likelihood signal expressed by probability can be an a priori probability and is associated with Laplacian (for speech) and/or Gaussian (for noise) probability distribution using the corresponding variance, and to combine the teachings of ERTEN by providing (a priori) probability and the

associated Laplacian (for speech) or Gaussian (for noise) probability distributions using variance, as suggested by ERTEN, for the purpose (motivation) of using various statistical measures for extracting properties of speech and noise and/or produce separated speech and noise signals from mixed a signal (ERTEN: p110 and p39).

As per **claim 16** (depending on claim 11), as state above, ERTEN discloses "computing a measure of fit of the components to a composite Gaussian and Laplacian distribution" (as describe for claim 1; also see ERTEN: p103 and p110).

As per **claim 17** (depending on claim 16), ERTEN further discloses "computing a measure of fit of each of the received components to a respective Gaussian noise distribution defined using the respective parameters; and comparing a mean of the measures of fit to the respective Gaussian noise distributions with a mean of the measures of fit to the composite Gaussian and Laplacian distributions, to compute a likelihood that the components of the frame constitute noise or noise-contaminated voice signal", (ERTEN: 103, 'properties (measures or parameters)... may include...statistical properties (necessarily including mean value), ...averages (broadly interpreted as mean values)...model fitting values (including measure of fit)'; p110, 'various other statistical measures'; Fig.5 and p90, 'generates (comparing result)...the difference between sound signal (corresponding to the composite Gaussian and Laplacian distributions) from microphone m2 and filtered noise signal (corresponding to Gaussian noise distributions)'; p113-p114, 'speech detected signal has such noise periods attenuated' (detecting noise) and 'speech likelihood signal may be a binary signal (implying either speech with noise or background noise only); which corresponds to the claim).

As per **claim 18** (depending on claim 17), ERTEN discloses "evaluating the distribution at the value of the component received" (with same reason described above; also see ERTEN: p110).

As per **claim 22** (depending on claim 1), ERTEN does not expressly disclose "computing at least an approximation to an expected value of the composite Gaussian and signal distribution using a respective value of each component, and the parameters, to obtain a corresponding signal-enhanced component, if it is determined that the frame is signal active". However, ERTEN teaches generating 'one or more noise signal properties' including 'statistical properties...average (approximation to an expected value)...model fit values (can also includes approximation to an expected value)' (p103), using 'Gaussian' and 'Laplacian probability distributions' with 'various statistical measures (including approximation to an expected value, such as the corresponding estimated sample value)' to 'determine the presence of voice' (p110); 'speech likelihood signal' and 'speech detector' (p114); and extracting 'noise signal' and producing 'detected speech signal (obtain a signal-enhanced component' (Fig. 5 and p90; and Fig. 7 and 105). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to recognize that a temporal (or ergodic) value of a test samples can be used as an approximation of statistical expected (ensemble) value, such as a time average can be an approximation of a mean (statistical expected) value, and to combine the different teachings of ERTEN by providing an approximation to an expected value with Laplacian and Gaussian (for noise) probability distributions, such as time average, suggested by ERTEN, for the purpose (motivation) of extracting properties of speech and noise and/or producing separated speech and noise signals from mixed a signal (ERTEN: p110 and p39).

As per **claim 24**, it recites an apparatus. The rejection is based on the same reason described for claims 1 and 22, because the rejection for claims 1 and 22 covers the same or similar limitation(s) as claim 24 (wherein 'speech likelihood signal' and 'speech detector' (p114) is read on "voice activity detector" with the associated functionality as claimed), except the limitation "an inverse signal transform for re-composing the frame of samples". However, this feature is further disclosed by ERTEN (p40, 'transform function inversion'; Fig. 8 and p109, 'combiner 170 performs...by an inverse-FFT to generate detected speech signal 34').

As per **claim 25** (depending on claim 24), ERTEN discloses "the clean speech estimator computes an expected value of each of the composite Gaussian and Laplacian distributions to independently derive a speech-enhanced component corresponding to each of the components" (p110, 'the variance (expected value) of extracted speech signal 28 or speech frequency bands (components) may be used to determine (evaluate) the presence of voice (corresponding to signal contributions)' and 'various other statistical measures, such as kurtosis, standard deviation (also expected values) ...may be extracted as properties of speech and noise signals or frequency bands (components)'; Fig. 8 and p108-p109, 'any property of speech frequency band o noise frequency band may be used' including 'statistical properties'; 'combiner 170 combines frequency band output (a speech-enhanced component) 168 for each speech frequency band 160 to generate detected speech signal').

5. Claims 5, 7-9 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over ERTEN in view of admitted prior art disclosure, hereinafter referenced as ADMISSION.

As per **claim 5** (depending on claim 4), ERTEN does not expressly disclose "mapping the frame comprises applying a **discrete cosine transform** to the frame of samples". However, the feature is well known in the art as evidenced by ADMISSION who teaches that 'there are many known transforms for decomposing (mapping) a frame of samples' and 'the most common of these include the frequency-domain transforms such as the Fourier transform, and the discrete cosine transform (DCT), wavelet decomposition transforms such as the standard wavelet transform (SWT), and adaptive transforms like the Karhunen-Loeve Transform' (p5-p6 in the section of "Background of the Invention" of the specification). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify ERTEN by providing a transform using DCT for the decomposition, as taught by ADMISSION, for the purpose (motivation) of providing low complexity decomposition technique (ADMISSION: p6).

As per **claim 7** (depending on claim 6), ERTEN does not expressly disclose decomposing the frame into "wavelets". However, the feature is well known in the art as evidenced by ADMISSION who teaches that 'there are many known transforms for decomposing (mapping) a frame of samples' and 'the most common of these include the frequency-domain transforms such as the Fourier transform, and the discrete cosine transform (DCT), wavelet decomposition transforms such as the standard wavelet transform (SWT), and adaptive transforms like the Karhunen-Loeve Transform' (see p5 and p7 in the section of "Background of the Invention" of the specification). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify ERTEN by providing a transform using DCT for the decomposition, as taught by ADMISSION, for the purpose (motivation) of better representing discontinuities for the signal (ADMISSION: p7).

As per **claims 8-9** (depending on claim 6), ERTEN does not expressly disclose "recomputing the basis functions to adaptively optimize decomposition" and "applying an adaptive Karhunen-Loeve transform". However, the feature is well known in the art as evidenced by ADMISSION who teaches that 'there are many known transforms for decomposing (mapping) a frame of samples' and 'the most common of these include the frequency-domain transforms such as the Fourier transform, and the discrete cosine transform (DCT), wavelet decomposition transforms such as the standard wavelet transform (SWT), and adaptive transforms like the Karhunen-Loeve Transform' (p5 and p7 in the section of "Background of the Invention" of the specification). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify ERTEN by providing a transform using DCT for the decomposition, as taught by ADMISSION, for the purpose (motivation) of maximizing the capacity of the basis functions to present the signal (ADMISSION: p7).

As per **claim 26** (depending on claim 25), the rejection is based on the same reason described for claim 5, because the claim recites the same or similar limitation(s) as claim 5.

6. Claims 12-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over ERTEN in view of VALVE et al. (US 6,707,910 b1), hereinafter referenced as VALVE.

As per **claim 12** (depending on claim 11), ERTEN does not expressly disclose "the a priori probability is defined by evaluating a hidden state of a hidden Markov model". However, the feature is well known in the art as evidenced by VALVE who discloses 'detection of the speech activity of a source'(title), comprising using 'HMMs (hidden Markov models—statistical models)' having 'probability density function (pdf: corresponding to a priori probability)' for

'speech activity detection' (col. 9, lines 22-49). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify ERTEN by providing HMMs with pdfs for speech activity detection, as taught by VALVE, for the purpose (motivation) of improving speech activity detection by utilizing statistical information (VALVE: col. 9, lines 9-13).

As per **claim 13** (depending on claim 12), ERTEN in view of VALVE discloses "incrementally changing the parameter in accordance with a difference between an expected value of the component given the past value of the parameter, and the value of the component received" (ERTEN: p53, 'the update law for (dynamic incrementally changing) environments is used to recover the original signals' and 'environment 42 is modeled as linear dynamical system'; p110, 'statistical measures (parameters)', such as 'variance', 'kurtosis' and 'standard' can be interpreted as expected value; wherein HMMs inherently include determining difference(s) (state changing) between current parameter(s) and the past value of the parameter(s), as claimed).

Allowable Subject Matter

7. Claims 14-15, 19-21 and 23 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

Regarding **claim 14**, the instant application is directed to a method for discriminating noise from signal in noise-contained signal. The depend claim, combining all well known features in its parent claim(s), further identifies the uniquely distinct features of:

wherein recursively updating a parameter further comprises incrementally changing the parameter in accordance with a difference between an expected value of the component given the past value of the parameter, and the value of the component received (from it parent claim 13);

and

wherein incrementally changing comprises applying a first order smoothing filter to the components (claim 14).

Regarding **claim 19**, the instant application is directed to a method for discriminating noise from signal in noise-contained signal. The depend claim, combining all well known features in its parent claim(s), further identifies the uniquely distinct features of:

wherein comparing a mean of the measures of fit comprises dividing a product of the measures of fit of the components to the composite Gaussian and Laplacian distribution by a product of the measures of fit of the components to the noise distribution.

Regarding **claim 23**, the instant application is directed to a method for discriminating noise from signal in noise-contained signal. The depend claim, combining all well known features in its parent claim(s), further identifies the uniquely distinct features of:

wherein computing at least an approximation comprises computing a piece-wise linear function approximation of the expected value as a function of the parameters and the component.

Regarding claims **15 and 20-21**, the statement for the allowable subject matter is based on the same reason described for claim 14 and 19 (see above), because these dependent claims inherit all laminations of their parent claims 14 and 19 receptively.

8. The prior art of record, ERTEN (US 2002/0116187 A1), VALVE et al. (US 6,707,910 b1), and ADMISSION, provided numerous teachings and techniques of speech detection, including extracting speech signal/noise signal from mixed input signal, estimating the signal characteristics, extracting features/parameters using spectral properties and statistical properties, providing feed forward and feedback voice extractor models, updating the matrix parameters of the models, using widowed signal and FFT transform, obtaining variance and various other statistical measure based on Lapacian probability distribution of voice signal and Gaussian probability distribution of noise, attenuating/scaling the extracted signal; applying know transform for decomposing signal including DCT, wavelet and Karhunen-Loeve Transform; using HMM with probability density function (a priori probability) for speech activity detection. However, the combined features stated above, are not anticipated by, nor made obvious over the prior art of the record.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a). A shortened statutory period for reply to this final action is set to expire THREE MONTHS from

the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Qi Han whose telephone numbers is (571) 272-7604. The examiner can normally be reached on Monday through Thursday from 9:00 a.m. to 7:30 p.m. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richemond Dorvil, can be reached on (571) 272-7602.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Inquiries regarding the status of submissions relating to an application or questions on the Private PAIR system should be directed to the Electronic Business Center (EBC) at 866-217-9197 (toll-free) or 703-305-3028 between the hours of 6 a.m. and midnight Monday through Friday EST, or by e-mail at: ebc@uspto.gov. For

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QH/qh
July 24, 2007

RICHEMOND DORVIL
SUPERVISORY PATENT EXAMINER